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Probing colour reconnection and underlying event in top quark events at the LHC

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Improvement in Monte Carlo (MC) event generators is critical for precise measurements in top quark events at the LHC. In fact, modelling of the color reconnection (CR), a mechanism that describes the interactions between coloured particles during the hadronization, and the underlying event (UE), defined as all particles produced from soft-hadronic processes and partially radiation form the hard scattering process (HS), are the main sources of uncertainty in many measurements. Measurements of observables sensitive to them are thus required to constrained the parameters of these MC models to reduce the uncertainty in top quark simulation. Two different ttbar channels, dileptonic and boosted all hadronic, are used to study respectively the UE and the CR.

While a top (or anti-top) quark with a large transverse momentum decays into a boosted Wb (or Wbbar), jets initiated by partons, produced from the decay of these boosted objects, and their radiative gluons are likely to cluster into a large-radius jet. We probe if one can define a geometric area in the neta-phi plane inside these large-radius jets, that are sensitive to color reconnection. The singlet color connected jets from the decay of the W boson can be used as a benchmark.

For the measurement of the activity of the UE in dilepton ttbar, we will study observables sensitive to the UE in the transverse region in conjunction with event shape observables. Even though this region is perpendicular, by construction, to the sum of the transverse momentum of the decay product of particles interacting via HS, it still receives some extra-jets from the HS. Thus we look for event topology where the transverse region is less contaminated by these extra-jets.

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